



Molecular Imaging Services
Advanced Molecular Imaging Solutions



CARDIAC PET

**A non-responder with subsequent
Triple Vessel CAD: is Caffeine
Withdrawal for 24 hours enough?**

Ronald Sher, MD
Cory Kress, CNMT
Rosemary Englebach, CNMT
Clinical Associates: Reisterstown, Maryland



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Case Summary

A 83 year old female patient with known CAD undergoes a rest/stress PET MPI study with myocardial blood flow assessment for pre-op evaluation and has normal perfusion but no increase in blood flow. Caffeine had been withheld for 24 hours. A repeat study after cessation of caffeine for 48 hours revealed a reversible inferolateral defect with minimal blood flow increase and at catheterization had multivessel CAD. This case emphasizes the importance of follow-up after normal perfusion and “non-responder” to myocardial blood flow.



Case History

- 78 year old female patient with MI and PCI performed 2004
 - Cardiac catheterization 2011 no significant residual disease
- Reason for study: pre-op for mastectomy
- Given mildly abnormal SPECT several years prior and limited exercise ability, cardiac rest/stress PET with myocardial blood flow assessment ordered



PET Protocol Rest/Stress PET #1

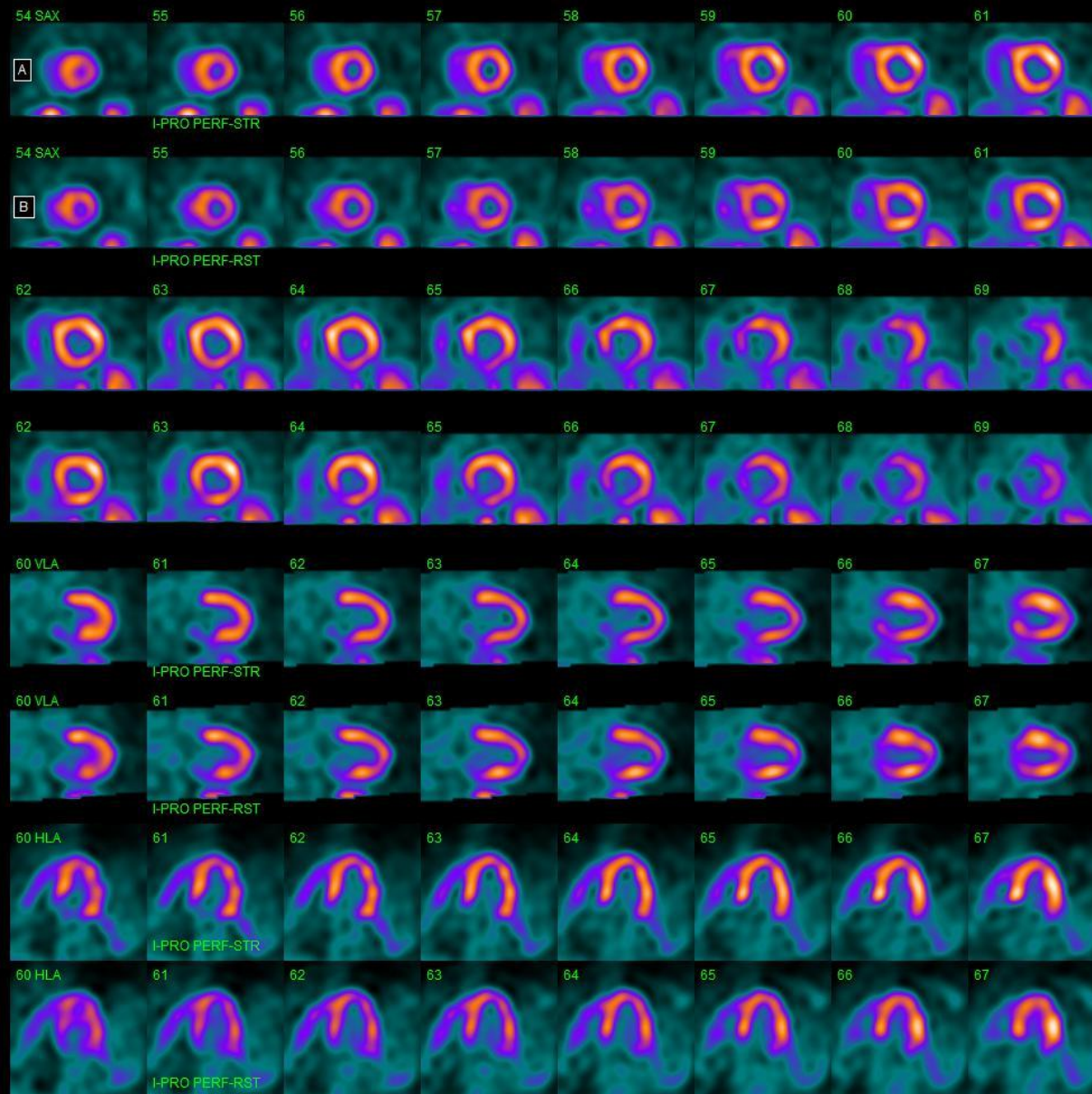
- Stress agent: regadenoson
- Stress ECG: nonspecific changes
- Stress symptoms: none
- Rest and stress HR: 56 BPM at rest. 65 BPM at stress
- Rest and stress BP: 165/72 at rest, 193/77 at stress
- Isotope and administered activity: 55.1 mCi rest, 55.0 mCi stress
- Camera system: GE Discovery NXI
- Myocardial Blood Flow: net retention model



Quality Control Test #1

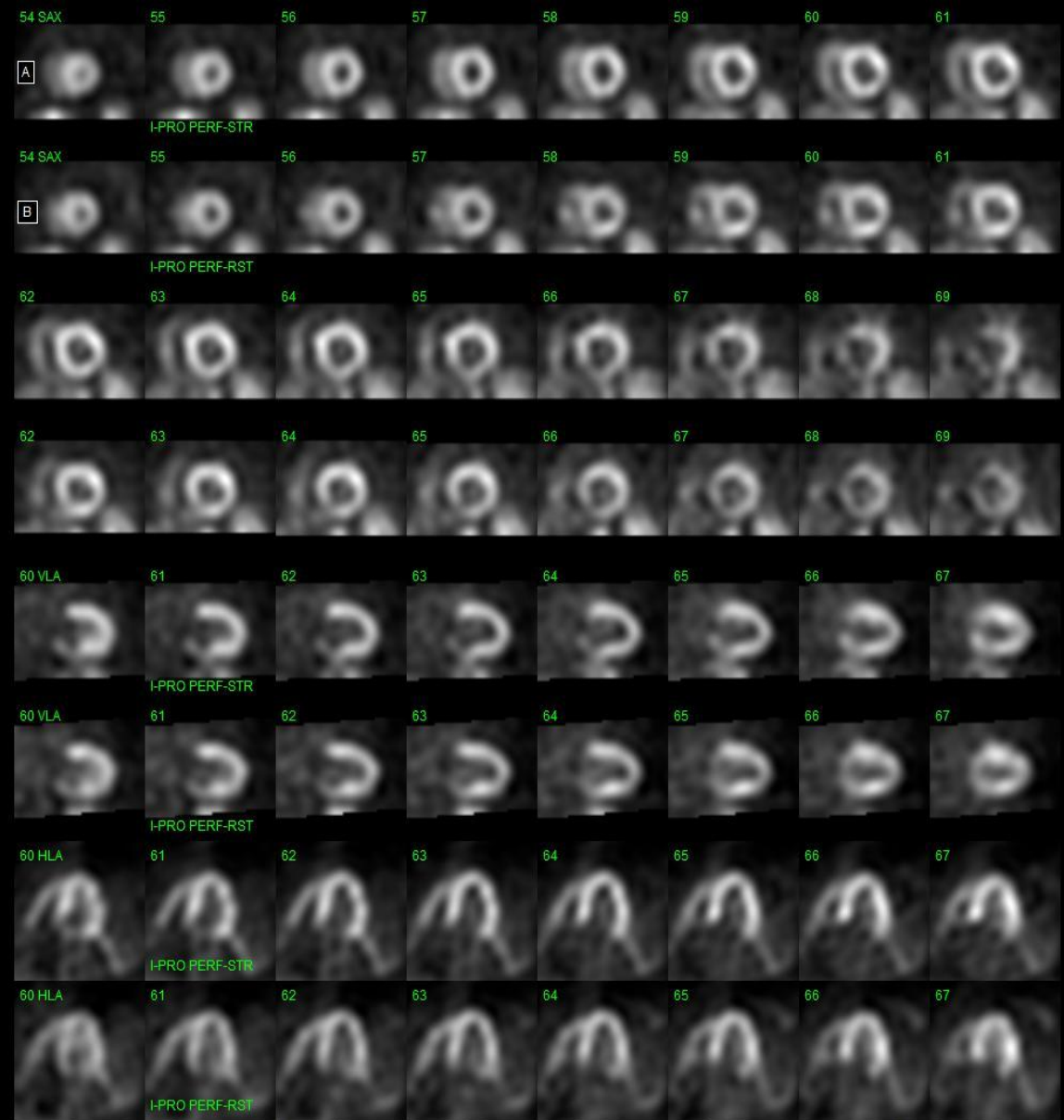
- Good image quality
- No Misregistration
- QC for Myocardial blood flow good





NOT FOR DIAGNOSTIC USE





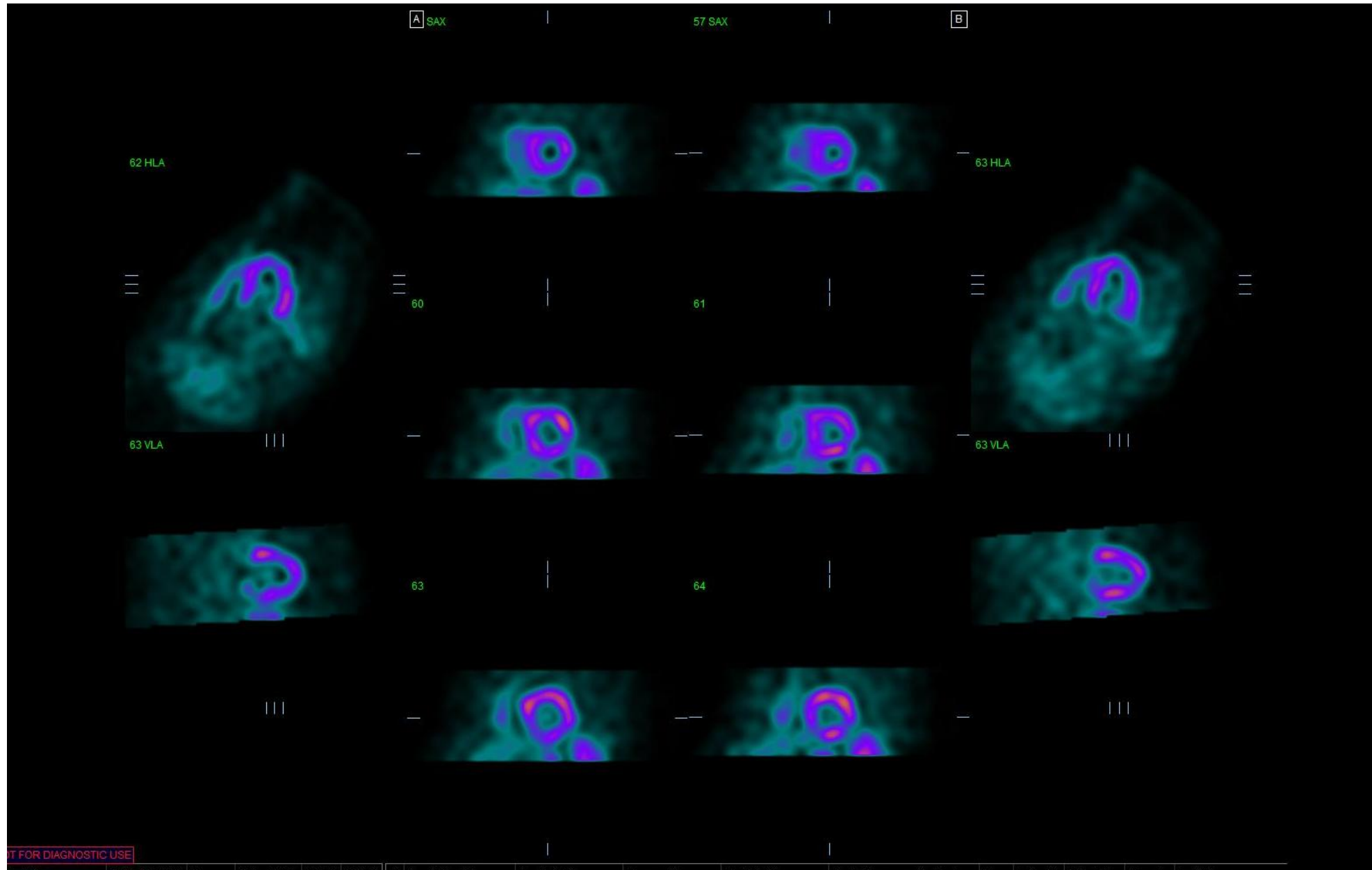
NOT FOR DIAGNOSTIC USE

Patient Name	Patient ID/MRN	Sex	Date of Birth	Height	Weight	#	Acquisition ID	Acq Date/Time	Process ID	Prc Date/Time	RadioPharmaceutical/Isotope	Dose	Laterality	Orientation	Operator	Institution
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**Rest EF:
74%**

**Stress EF:
73%**



Interpretation of Study #1

- **Myocardial Perfusion:** slight motion but normal perfusion, TID: 1.11
- **Gated wall motion:** normal function, no change in EF between rest and stress
- **Myocardial blood flow:**
 - Good QC
 - Normal resting flow with uniform distribution (global 0.56)
 - No increase in stress flow uniformly (global 0.59)
 - Abnormally low MBFR consistent with non-response to vasodilation (1.09)



Interpretation, Plans after Test #1

- Normal perfusion, no change in EF and no increase in blood flow indicates vasodilation has not occurred
- A study with normal perfusion and no increase in blood flow is an “inconclusive” test and CAD has not been excluded
 - It is recommended that a cause for lack of vasodilation be sought, and if found, repeat study performed
 - If no cause, another procedure should be ordered: CTA, cardiac catheterization, stress echo
- The findings were discussed with the patient who reported caffeine withheld for 24 hours, as per laboratory protocol
- A repeat rest/stress Cardiac PET with MBF was ordered, off caffeine for 48 hours



PET Protocol Rest/Stress PET #2

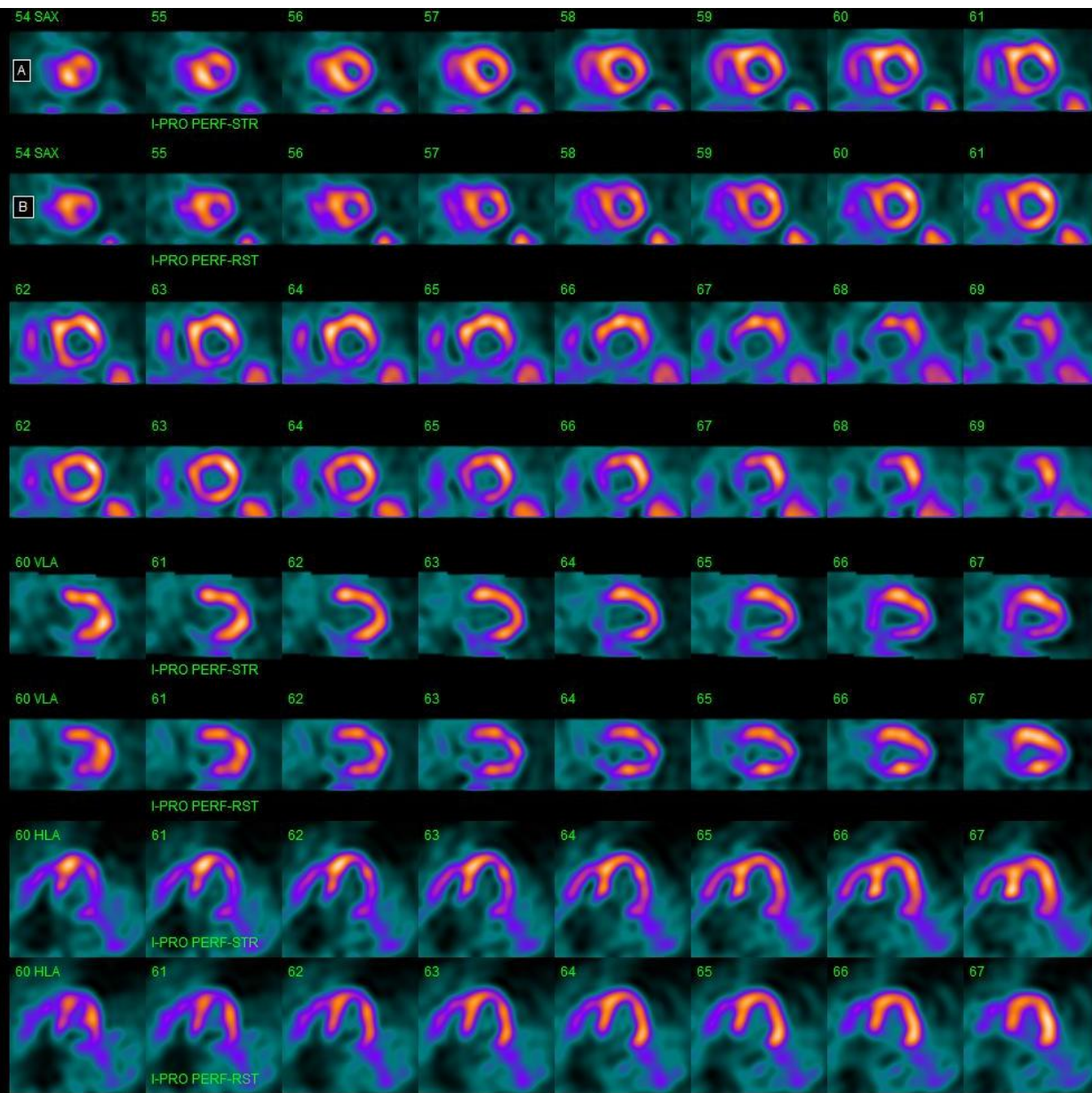
- Stress agent: regadenoson
- Stress ECG: non-specific changes
- Stress symptoms: no symptoms
- Rest and stress HR: 66 at rest, 88 BPM at stress
- Rest and stress BP: 130/60 at rest. 216/83 at stress
- Isotope and administered activity: 55.0 mCi at at stress, 42.8 at stress
- Camera system: GE Discovery NXI
- Myocardial Blood flow: net retention model



Quality Control Test #2

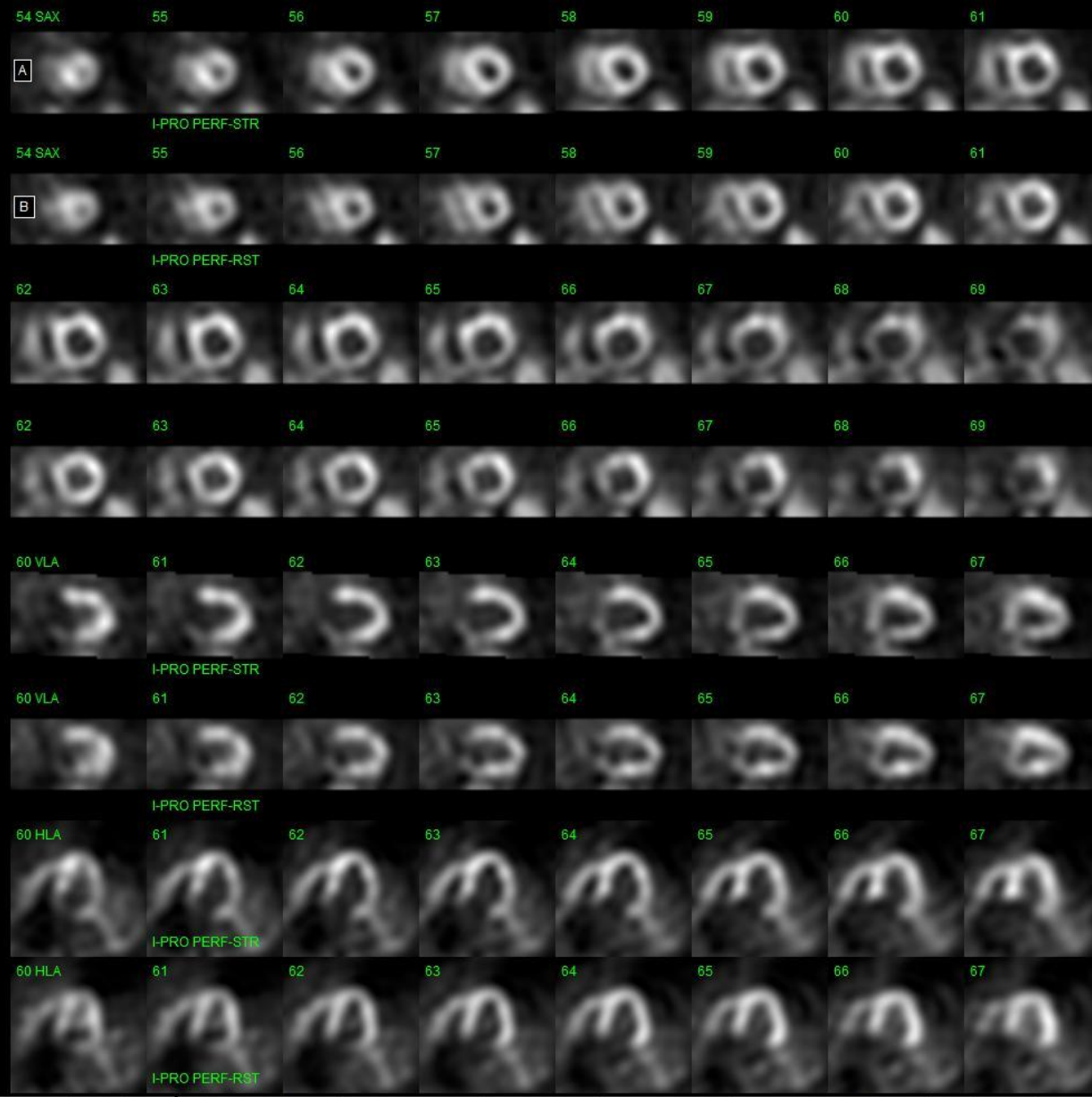
- Good image quality
- No Misregistration
- QC for Myocardial blood flow good





NOT FOR DIAGNOSTIC USE



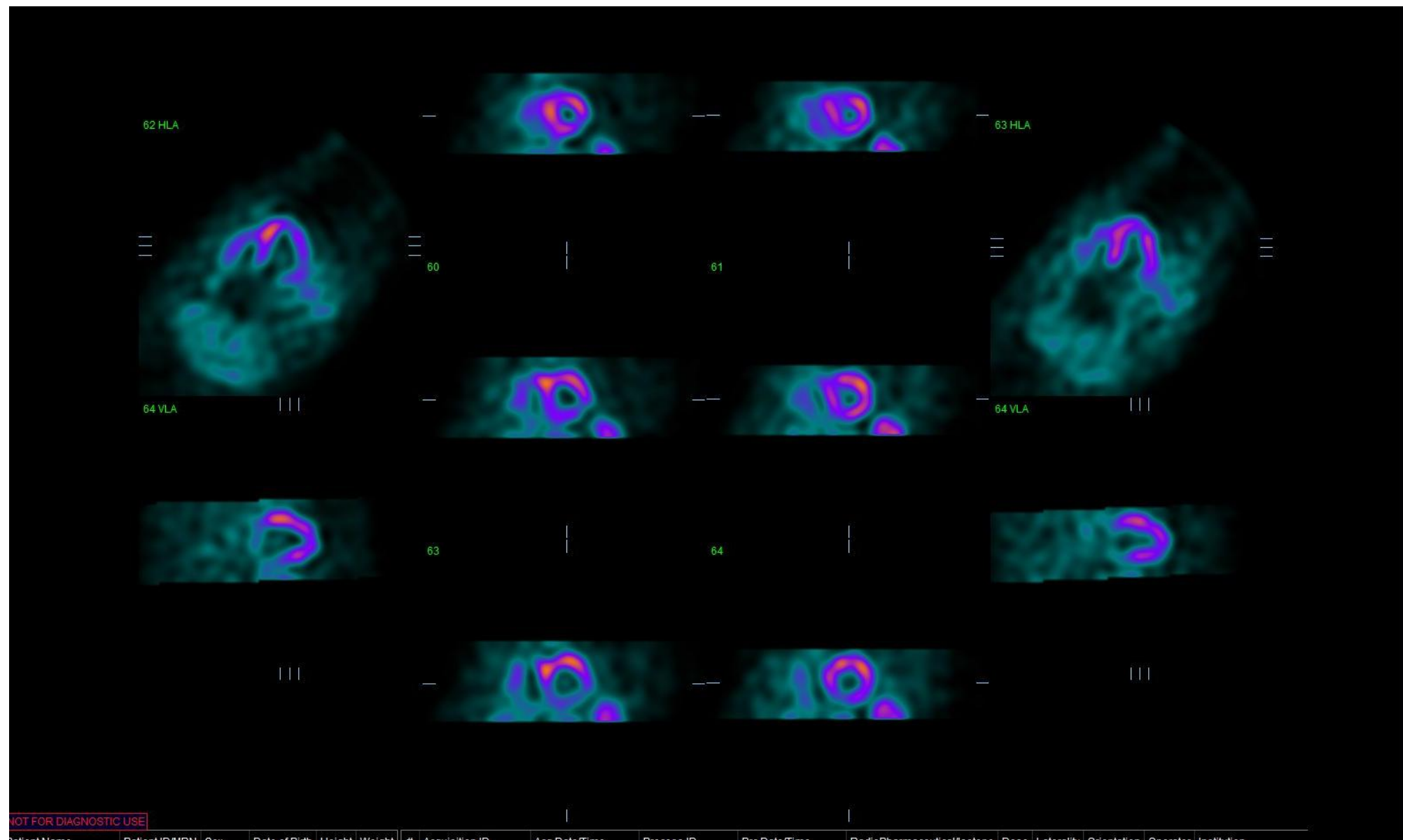


NOT FOR DIAGNOSTIC USE



**Rest EF:
77%**

**Stress EF:
62%**



Quality Indicators

Background

- Stress 0.000671
- Rest 0.

Peak to Plateau

- Stress 6.13129
- Rest 6.793433

Peak Time

- Stress 55
- Rest 55

Noise

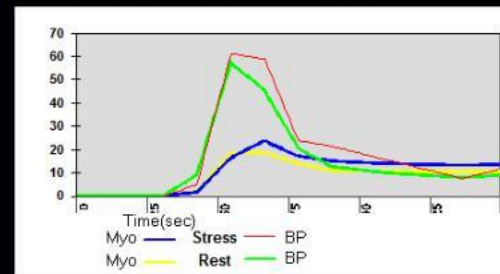
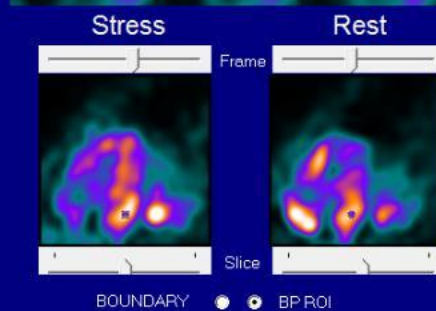
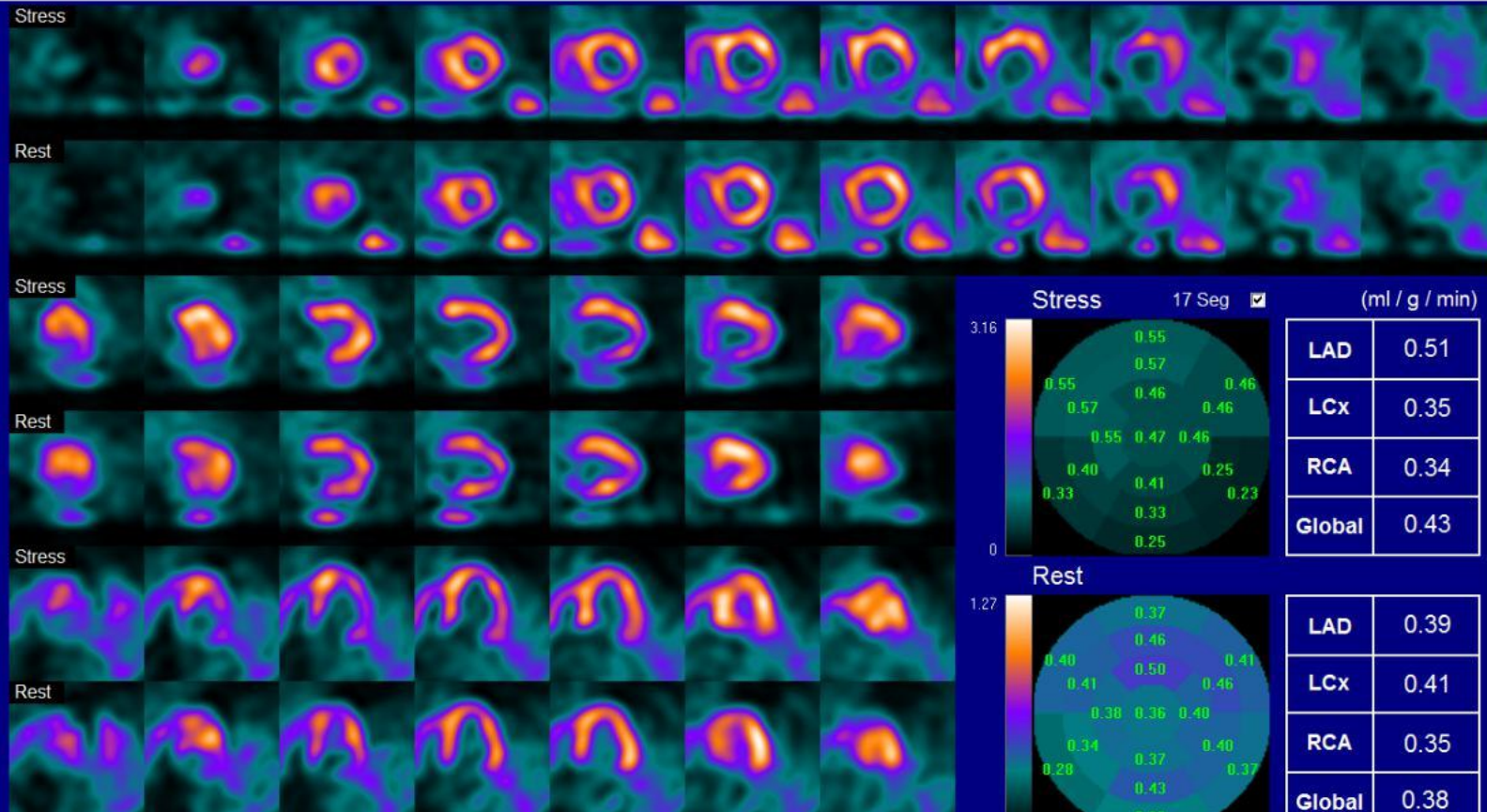
- Stress 0.289546
- Rest 0.165182

Slice Palette



Zoom 3

Exam Details



NOT FOR DIAGNOSTIC USE

Patient Name	Patient ID/MRN	Sex	Date of Birth	Height	Weight	#	Acquisition ID	Acq Date/Time	Process ID	Prc Date/Time	RadioPharmaceutical/Isotope	Dose	Laterality	Orientation	Operator	Institution
HOUCK JEANNE	79479261	FEMALE	1947-04-08	N/A	N/A	A	PET-HOUC26130711	2023-07-11 12:46:07	Workstation Display Screen	2023-07-11 12:46:07	N/A	N/A	Supine	Unknown	N/A	N/A

Results: PET Study #2

- **Myocardial perfusion** demonstrated a medium moderate reversible inferior and inferior/lateral defect. TID was 1.29 (previous 1.11)
- **ECG Gated study:** Normal wall motion but with a significant drop in EF at Stress: 77% rest, 62% at stress (previously no change)
- **Myocardial blood flow study:**
 - QC good
 - Rest study: normal with uniformity (global 0.38)
 - Stress study: minimal increase in LAD, no change in LCx or RCA
 - Myocardial Blood Flow Reserve: LAD 1.30, LCx 0.85, RCA 0.98, global 1.11



Discussion

- The second study was abnormal for a reversible defect, T1D and abnormal ventricular function with a drop in EF and. The global flow reserve indicated a non-response to vasodilation, but in the presence of a reversible defect, this is considered a high risk for CAD and cardiac related events (1).
- The patient underwent coronary catheterization, was found to have 3 vessel CAD, and recommended for Coronary Artery Bypass Surgery



Cath results here



Discussion (2)

- This case illustrates that a nuclear PET study with normal perfusion and no augmentation of blood flow represents an inconclusive examination, and that CAD has not been excluded. If a “culprit” such as caffeine consumption can be identified, the study should be repeated off caffeine. In this case, caffeine had been withheld for 24 hours and the study was repeated off caffeine for 48 hours
- The second study demonstrates the dramatic effect that a vasodilator–inhibitor such as caffeine has, and demonstrated severe ischemia and 3 vessel CAD at catheterization



Discussion Continued

- The second study also illustrates the phenomenon of a reversible defect in the presence of no increase in blood flow. It is generally thought that this is due to severe epicardial CAD and pre-existing maximal coronary vasodilation. The hemodynamic changes most likely represent effects in the periphery
- The importance of this case is that caffeine effects in certain patients may be quite prolonged. While withholding caffeine for 48 hours is generally not recommended for all patients, for patients who do not show an increase in blood flow after 24 hours one should consider longer withholding of caffeine.



Categories of Myocardial Blood Flow Reserve

Table 1. General Interpretation and Classification of Risk in Relation to Global MBFR

MBFR	Interpretation	CAD Risk
>2	Normal	Low
1.7-2	Low-normal	Intermediate
1.2-1.69	Abnormal	High
<1.2 with a perfusion defect	Highly abnormal	Very high
<1.2 without a perfusion defect	Consider non-diagnostic study	Indeterminate

Case study #2

Case Study #1

**Cutoffs are generally arbitrary and may vary slightly between labs.
The principle is that the lower the flow reserve the greater the risk.**

*ASNC Information Statement Bateman et al JNC/JNM Online 2021



References

- Bateman TM, Heller, GV, Beanlands R et al Practical guide for interpreting and reporting cardiac PET measurements of myocardial blood flow: an Information Statement from the American Society of Nuclear Cardiology, and the Society of Nuclear Medicine and Molecular Imaging J Nucl Cardiol
- Murthy VL, Bateman TM, Beanlands RS et al Clinical Quantification of Myocardial Blood Flow Using PET: Joint Position Paper of the SNMMI Cardiovascular Council and the ASNC J Nucl Cardiol 2018;25;269-97



Key Words

- Myocardial blood flow, inadequate vasodilation

